EXTRAORDINARY RAINFALL IN TEXAS.

By H. A. HAZEN, Professor, Weather Bureau (dated August 1, 1899).

During the last four days of June, 1899, the heaviest rainfall in the records of Texas occurred near the headwaters of the Brazos River and caused the disastrous floods in that valley. Turnersville, about 240 miles from the Gulf, had over 33 inches of rain in ninety hours, and Hearne, some 80 miles toward the southeast, reported over 30 inches. Probably an area of nearly 2,000 square miles experienced a rain of about 30 inches in less than four days. During the last twelve Junes rains of over 10 inches a month have occurred at 19 stations, or less than two a month. In June, 1899, 12 stations reported over 10 inches in only four days. The remarkable fact is that these rains occurred so far from the Gulf. Point Isabel, on the Gulf coast, reports no rain at all in these four days. Of the 100 stations reporting more than 10 inches in any one month in the past twelve years, over 80 per cent have been located more than 50 miles from the Gulf. It should be noted that the data studied are not strictly comparable, because in 1888 the number of stations reporting rainfall in Texas was very much less than at present. The heaviest of the rains in the present June occurred on land gradually rising from 500 to 2,000 feet, and this is probably an important factor in their formation. The heaviest rainfall in the world, sometimes over 200 inches in a single month, occurs at Cherapunjee, on the Khasia hills in India, and where the land slopes up to 4,000 feet above sea level.

An examination of the weather maps shows the remarkable fact that there was no serious disturbance of the atmosphere in Texas at the time of these rains. On the morning of the 27th there was a slight storm area between Galveston and Corpus Christi, but the only rain was 2.02 inches, at Galveston. The same evening Galveston had 0.68 inch, but this was practically all at this station during the four days. On the evening of the 27th all the winds on the Gulf coast were from the southeast, showing that the slight storm had advanced entirely upon the land. The wind at Palestine, the nearest regular station, throughout the heavy rains was from the northeast, and steady at about 8 miles an hour. The pressure rose steadily at Palestine from 29.86 inches, the lowest, on June 26 at 8 p. m. The total rainfall at Palestine was 7.42 inches.

If we allow for the full effect of topography and for the impinging of north winds from an advancing high pressure area upon the south and southeast winds of the slight storm, we must still acknowledge their entire inadequacy to account for such heavy downpours as these. We must admit the great lack of facts on which to base a complete explanation. It is probable that the phenomena were analogous to those attending the so-called cloud-bursts, about the cause of which almost nothing is known.

OBSERVATIONS AT RIVAS, NICARAGUA.

The records contributed for many years by Dr. Earl Flint, at Rivas, Nicaragua, include barometric readings. His present station is at 11° 26′ N., 85° 47′ W. The observations at 7:17 a. m., local time, are simultaneous with Greenwich 1 p. m. The altitude of his barometer is 36 meters above sea level, but until the barometer has been compared with a standard it seems hardly necessary to publish the daily readings. The wind force is recorded on the Beaufort scale, 0–12. When cloudiness is less than $\frac{1}{10}$, the letter "F," or "Few," is recorded.

This station is situated on the western shore of Lake Nicaragua, not far from the eastern end of the western division of the Nicaragua Canal. The volcano Ometepe, on an island in Lake Nicaragua, is about 10 miles northeast of the station. Mr. Flint's records occasionally mention the presence of clouds on the summit of this mountain.

Dr. Flint's reports to the Weather Bureau now embrace two distinct features, namely, the simultaneous morning observations and the daily climatological summary, as given in the two following tables for each month.

Simultaneous observations at 1 p. m. Greenwich (or 7:17 a. m. local) time, June, 1899.

Date.	Temperature.		Wind.		Upper clouds.			Lower Clouds.		
	Air.	Dew-point.	Direction.	Force.	Kind.	Amount.	Direction from.	Kind.	Amount.	Direction from.
	°	°								
1	79	72	ne.	6	.....	.....	.....	k.	10	ne.
2	79	71	ne.	4	cs.	10	sw.	.....	.....	.....
3	79	73	ne.	3	cs.	5	sw.	k.	1	ne.
4	80	75	ne.	3	cs., ks.	10	sw.	k.	Few	ne.
5	80	76	ne.	0	ck.	6	sw.	ak.	2	ne.
6	78	73	n.	0	.....	.....	.....	ak.	8	n.
								k.	1	ne.
7	78.5	74	ne.	4	.....	.....	.....	k.	10	ne.
8	77	74	ne.	0	ck.	8	sw.	k.	2	ne.
9	76.5	73	nw.	0	.....	.....	.....	kn.	10	nw.
10	75.5	72	ne.	0	.....	.....	.....	kn.	10	ne.
11	77	74	ne.	0	.....	.....	.....	kn.	10	ne.
12	78	74	ne.	3	.....	.....	.....	k.	10	ne.
13	79	73	ne.	5	ck.	10	sw.	.....	.....	.....
14	80	74	ne.	3	.....	.....	.....	f. k.	9	ne.
15	80	73	ne.	5	.....	.....	.....	f. k.	4	ne.
16	79.5	72	ne.	3	.....	.....	.....	f. k.	3	ne.
17	79.5	72	ne.	4	.....	.....	.....	ak., sk.	6	ne.
18	79	75	ne.	3	.....	.....	.....	k.	7	ne.
19	80	74	ne.	5	.....	.....	.....	as., k.	10	ne.
20	76.5	73	ne.	1	.....	.....	.....	ak., k.	9	ne.
21	79	76	ne.	3	.....	.....	.....	k.	6	ne.
22	79.5	75	ne.	3	.....	.....	.....	k.	10	ne.
23	80.5	73	ne.	5	ck.	9	sw.	k.	1	ne.
24	80.5	72	ne.	5	ck.	10	sw.	.....	.....	.....
25	80	73	ne.	3	.....	.....	.....	f. k.	5	ne.
26	80	73	ne.	6	.....	.....	.....	ak.	2	ne.
27	80	74	ne.	4	.....	.....	.....	k.	10	ne.
28	81	74	ne.	6	.....	.....	.....	ak.	1	.....
								k.	2	ne.
29	80	76	ne.	3	.....	.....	.....	k.	10	ne.
30	78.5	71	ne.	4	ck.	2	sw.	ak., k.	1	ne.
Means	79.0	.....	.....	.....	.....	.....	.....	.....	.....	.....

Climatological observations for twenty-four hours ending at 7:17 a. m. local (or 1 p. m. Greenwich) time, June, 1899.

Date.	Temperature.		Wind.		Average cloudiness.	Total rainfall.
	Maximum.	Minimum.	Prevailing direction.	Maximum force.		
	°	°				*Inches.*
1	88	74	ne.	5	5	0.00
2	90.4	78	ne.	6	3	0.00
3	87	76	ne.	5	9	0.00
4	90.4	78	ne.	5	3	0.00
5	89	76.5	ne.	4	5	0.06
6	89.2	78	ne.	3	5	0.99
7	87	76.5	ne.	5	8	0.00
8	84	77	ne.	5	10	1.15
9	84	76	se.	4	9	0.62
10	85	75	sw.	3	7	2.76
11	82	74.5	ne.	4	10	0.00
12	84.2	75	ne.	3	7	0.45
13	82	76	ne.	6	9	0.13
14	87	76.2	ne.	5	8	T.
15	86	78	ne.	5	7	0.00
16	88	78.5	ne.	5	3	0.00
17	87.5	78	ne.	6	4	0.00
18	88	78	ne.	7	6	0.33
19	84	78.2	ne.	4	9	0.31
20	82	76	ne.	5	10	0.35
21	84.4	75	ne.	4	3	0.00
22	87.2	76	ne.	3	5	0.00
23	89.5	77	ne.	6	5	0.00
24	89	78	ne.	6	7	0.00
25	87	78	ne.	5	8	0.32
26	88	79	ne.	4	2	0.00
27	87	78	ne.	6	3	0.00
28	87	79	ne.	5	8	0.06
29	87	79	ne.	6	9	0.00
30	84	78	ne.	5	8	0.16
Sums	.....	.....	.....	.....	.....	7.69
Means	86.5	77.0	.....	.....	.....	.....